A Method to Estimate Hand Volume Based on Metric Measurements
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Determining upper extremity limb volume and its change during therapy for edema or lymphedema is needed to assess treatment efficacy and outcomes. A near circular cross-section of the arm permits its volume to be accurately estimated with tape-measure-determined circumferences and suitable calculation formulae. However, because of the hand’s shape, circumference-determined-volumes may not be accurate. Our aim was to develop and test a metric measurement procedure and algorithm that could usefully estimate hand volumes as an alternative to water displacement. Both hands of thirty volunteers were evaluated. The method tested uses a caliper to measure hand dimensions at standard locations and calculates volume ($V_M$) by a software algorithm**. $V_W$ was compared to volumes measured by water displacement ($V_W$) and tape-measure-determined circumferences ($V_T$) in 30 subjects (60 hands) using regression analysis and limits of agreement (LOA).

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**RESULTS:** Volumes determined by water displacement ($V_W$) and by the new metric method ($V_M$) were similar $(r=0.987, p<0.001)$. The LOA for absolute volume differences and percentages were respectively $\pm 33.3 \text{ ml}$ and $\pm 9.9 \%$. Circumference-determined-volumes ($V_T=485 \pm 134 \text{ ml}$), significantly overestimated hand volume compared to $V_M$ and $V_W$ ($p<0.001$).

**CONCLUSIONS:** Results indicate that this metric method to together with the algorithm is useful when hand volumes are needed, but water displacement is either not available or is contraindicated, as when open wounds are present.

Dr. Mayrovitz welcomes your comments and queries. You may contact him at: mayrovitz@nova.edu